claim 1, however, because it does not disclose the claimed feature of a portion of the blade (i.e. the tip) having a pitch angle fixed relative to the rotating plane, as demonstrated below.

Definition of The Term "Fixed" as used in Claim 1

Claim 1 specifies that at least a part of one or more of the rotor blades has a pitch angle that is fixed relative to the rotating plane.

In the current application the word "fixed" is used to describe a situation were something is inherently constant, meaning that under normal use it is not possible for a part that is fixed with respect to another part to change its position or orientation with respect to that other part. Fixed further implies that the relationship remains constant at all times. In the application the word fixed is used to describe "fixed connections" and "fixed angles":

- The term "At their tip the rotor blades are fixed to a ring encircling the whole rotor" is used several places in the present application e.g. page 9, line 20-21, to describe that one part is physically connected to another part in a way that prevents the two parts from being able to move with respect to each other. It is a fixed connection opposed to e.g. a connection via pivots or hinges.

- The other and important use of the word fixed is in the term, "....have a pitch angle generally fixed relative to the rotating plane" e.g. page 14, line 7-8 and in the claims. Here the word "fixed" is referring to the condition where the angle or orientation of one part with respect to another part or a plane is always constant. The angle is not changing whatever happens to the rest of the system. If a part of a rotor blade has a fixed pitch angle with respect to the rotating plane the term "fixed" therefore means that the angle of this part keeps its original angle with respect to the rotating plane even if the plane is tilted or if the rotor is rotating through different positions during a revolution. This use of the word "fixed" is described several places in the current application e.g. page 14, line 11-13.

On this background it will be appreciated that the word fixed is used when something must always remain constant as opposed to something that only occasionally or in some positions happens to have an orientation similar to the original one. In particular a pitch angle that is fixed relative to a plane is an angle that maintains a constant pitch angle at any position as it rotates around that plane. This is further supported by the fact that the claim specifies “a rotor generating lift” (which will of necessity be a rotor that is rotating), as well as the fact that the plane under discussion is called the “rotating plane”, (clearly implying that the rotor will rotate). Hence, the term “a pitch angle generally fixed” as used in claim 1 of the present application is a specific feature of the claimed rotor.

Barltrop does not disclose a blade having a pitch angle fixed to the rotating plane

With the above clarification of the word “fixed” we will now discuss why the Barltrop rotor does not disclose the claimed feature of “...at least a part of one or more of the rotor blades has a pitch angle generally fixed relative to the rotating plane...”

As demonstrated to the examiner in the interview, the prior art rotor shown in Barltrop’s figs 1-3 is a fixed-pitch two-bladed teetering rotor. With such a rotor it is possible for the tips of the blades to follow a path defining a tilted rotating plane. In order to do so, the blades “teeter” about a horizontal hinge pin. If one assumes, for example, a rotating plane that is tilted up in the direction of flight, the highest part of the rotating plane will be directly forward, and the low part of the plane will be directly aft. When the blades of a teetering rotor are pointing out to the sides, the blades will be generally level to the ground. As one blade advances following the tilted plane, the rotor blade will “teeter” about the hinge, with the tip rising progressively higher and higher until it reaches the high point directly forward. As the blade retreats, the rotor will “teeter” about the hinge in the opposite direction, with the tip of the blade sinking progressively lower and lower until it reaches the low point of the plane directly aft.

As demonstrated to the examiner, the <u>pitch angle</u> of such a blade (as well as a blade of a Barltrop rotor) changes with respect to the rotating plane as the rotor teeters about the hinge and blade moves through different positions during a revolution. As can now be appreciated, the blade's pitch angle at the exact low point where the rotor blade is pointing aft and at the exact high point where the rotor blade is pointing forward is unchanged with respect to the tilted rotating plane. In the exact moment when the rotor blade passes this position the teetering hinge axis is parallel to the tilting axis of the rotating plane and the pitch angle with respect to the rotating plane therefore happens to be the same as originally.

However, when the rotor rotates and the low blade starts to tilt up and the high blade starts to tilt down this is changed. After rotating 90 degrees, at the middle point between the low and high points, the two rotor blades are generally at the same horizontal level. In this position, looking from the tip of the rotor blade and inwards, it was shown that the pitch angles of the rotor blades still have the original (fixed) angle with respect to the reference plane but not any longer with respect to the tilted rotating plane. At this point of the rotation when the rotor blades are generally level, the rotor blades have their maximum and minimum angles with respect to the tilted rotating plane.

In addition to the visual demonstration of this principle, the relationship can be defined mathematically. (It is not believed that the following is new matter, or that the following need be added to the specification for enablement reasons, as the discussion is believed to be well within the knowledge of one skilled in the art).

Mathematical discussion of the rotor blades' pitch angle with respect to the rotating plane in a rotor according to Barltrop.

Barltrop describes in detail how the difference in lift on the retreating blade and on the advancing blade causes the rotating plane to tilt, e.g. at column 3, line 50-65 of his patent. When the rotating plane is tilted like this, we have explained how the pitch angles with

respect to the rotating plane will always and continuously vary above and below the original angle as the rotor rotates and therefore the pitch angles are not fixed relative to the rotating plane.

The following discussion applies not only to the prior art rotor shown in Barltrop's figs 1-3, but to the rotor that Barltrop considered his invention as well. The Barltrop rotor has a special feature that links the blade's pitch angle to the coning of the rotor. The coning, hence also the pitch angle, varies with the load on the rotor. In order to study the pitch angle with respect to the rotating plane we assume a stationary situation with constant load on the rotor. This stationary situation is when the Barltrop rotor most resembles the rotors described in the current invention (in as much as a load that is not constant would certainly not result in a fixed pitch angle).

Definitions (please also see the figures below):

The reference plane is defined as a plane that is perpendicular to the rotor shaft axis.

The rotating plane is defined by the path that the tips of the rotor blades follow when the rotor rotates.

A Pitch angle with respect to the rotating plane.

B Angle between the rotating plane and the reference plane.

C Pitch angle with respect to the reference plane.

D Position of a rotor blade as it rotates, measured from 0 to 360 degrees; 0 when the blade we study is at the highest point of the tilted rotating plane (typically in the front) and 180 when the blade is in the opposite direction at the lowest point of rotation (typically to the aft).

Discussion:

The rotor blades in the Barltrop rotor (and other teetering rotors) are connected to the rotor shaft with a teetering hinge having a hinge axis perpendicular to both the rotor shaft axis and to the longitudinal axis of the two rotor blades. This teetering hinge enables the blades to tilt up and down (teeter). Because of the orientation of the teetering hinge; the blades' pitch angle (C) with respect to the reference plane will be generally fixed along the whole length of the blades.

When the Barltrop rotor rotates, the rotor blades ability to tilt up and down in a cyclic manner will allow the tips to follow a path that is tilted with respect to the reference plane, hence the rotating plane is tilted. During normal operation, a rotor that is free to tilt will because of the difference in lift on the advancing and the retreating blades, do so.

It is possible to mathematically describe the relationship between the pitch angle (A) with respect to the rotating plane, the tilting angle (B) of the rotating plane, the pitch angle (C) with respect to the reference plane and the position of a rotor blade as it rotates (D).

$A = C + \arcsin(\sin(B) * \sin(D))$

If we now consider a normal and stable (stationary) situation where the Barltrop rotor is spinning and generating lift while the rotor is moving trough the air, we can assume that the following angles are constant:

$B = 10$ (degrees)
$C = 15$ (degrees)

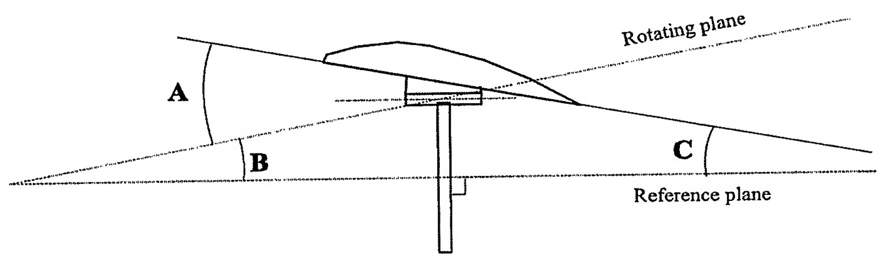
The pitch angle (A) with respect to the rotating plane will now be:
$A = 15 + \arcsin(0.174 * \sin(D))$

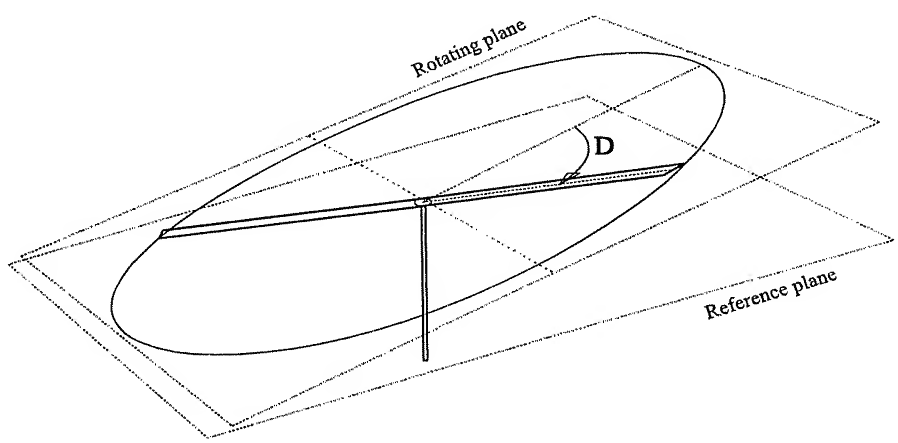
Numerical examples and conclusion:

D = 0	A = 15.0	(rotor blade pointing forward)
D = 45	A = 22.1	(rotor blade mid way between front and side)
D = 90	A = 25.0	(rotor blade to the side, retreating)
D = 170	A = 16.7	(rotor blade almost at the low point, pointing aft)
D = 270	A = 5.0	(rotor blade to the side, advancing)
D = 350	A = 13.3	(rotor blade almost pointing forward again)

As can clearly be seen, in Barltrop the pitch angle (A) with respect to the rotating plane is not constant or fixed as required by claim 1, but rather varies with the position (D) of the rotating blade. In contrast, a portion of the blade according the present invention as claimed (e.g. the tips) have a pitch angle that is "fixed" relative to the rotating plane, i.e. the pitch angle A is constant regardless of the position D.

Figures:





The present invention

Turning now to the rotor in the preferred embodiment of the present invention we can appreciate that the angular relationship described above is similar to what we have in the inner part of the flexible blades, i.e. the part that has a fixed pitch angle with respect to the reference plane. The blades of the preferred embodiment, however, have a second part, i.e. the tips, that are fixed to the ring encircling the rotor and thereby are forced to twist such that the tips have a pitch angle that is always constant, i.e. "fixed", relative to the ring. Since the ring is fixed to the tip of the rotor blades and since the tip of the rotor blades also per definition defines the rotating plane; the pitch angle of the tip of the blades will also be fixed with respect to the rotating plane.

The feature in the present invention where at least a part of one or more of the rotor blades has a pitch angle generally fixed relative to the rotating plane increases the tendency of the rotor to tilt in response to a horizontal movement. The reason for this increased tilting tendency is that the difference in lift on the advancing and retreating blades will be larger than if no part of the blades had a pitch angle that followed the tilting of the rotating plane. This feature and the consequences of it is normally the opposite of what a rotor designer wants because it drastically reduces the possible forward speed. However, in the present invention this feature enables the aircraft (helicopter) to remain in a stationary and stable hovering flight.

The rotor described in claim 1 and shown e.g. in figure 5 of the present invention has the following combination of characteristic features:

- the rotating plane (A) is tiltable in any direction with respect to a reference plane (B) perpendicular to the rotor shaft (18) axis,
- at least a part of one or more of the rotor blades (11) has a pitch angle (41) generally fixed relative to said reference plane (B),

- at least a part of one or more of the rotor blades (11) has a pitch angle (42) generally fixed relative to the rotating plane (A).

A two-bladed fixed pitch teetering rotor (as discussed above) has only 2 of these characteristic features. Typically rotors do not have the feature that "at least a part of one or more of the rotor blades has a pitch angle generally fixed relative to the rotating plane". The combination of all of these three features is new and unique and has never been either anticipated or foreseen, by Barltrop or others. This feature in combination with the two other features is what enables the rotor of the present invention to function and behave differently from all other known rotors.

The Barltrop rotor furthermore has a feature that increases the pitch angles of the rotor blades when the load, hence the coning, increases. In fact this is the main feature of the Barltrop rotor and with this feature even the fixed pitch angles of the rotor blades with respect to the reference plane are not fixed anymore. As Barltrop states at column 6, line 29, "An advantage of the rotor 20 according to the invention shown in figs. 4 to 8, when compared with the rotor 10 of figs. 1 to 3, is that the rotor 20 does not have a fixed blade angle". As can then clearly be seen; the rotor's ability to tilt is the only feature it has in common with the rotors described in the present application.

Conclusion

Based on the foregoing, it is respectfully believed that the applicant has demonstrated that claim 1 of the present application is not anticipated by Barltrop. Favourable reconsideration is therefore solicited.

# Interview Summary	Application No. 10/824,492	Applicant(s) MUREN, PETTER
	Examiner Tien Dinh	Art Unit 3644

All participants (applicant, applicant's representative, PTO personnel):

(1) Tien Dinh.

(2) Mr. Abel.

(3) Mr. Muren.

(4)_____.

Date of Interview: 14 December 2006.

Type: a)☐ Telephonic b)☐ Video Conference
c)☒ Personal [copy given to: 1)☒ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☒ Yes e)☐ No.
If Yes, brief description: Model helicopter.

Claim(s) discussed: 1.

Identification of prior art discussed: Barltrop.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: The applicant explained his invention and why it should overcome the primary reference Barltrop. The applicant has explained the invention with the use of the models to show the rotor's workings.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Tien Dinh

Examiner's signature, if required